



***Dedicated to my beloved
Grandparents
(L) Leten & (L) Anem***

Declaration by the Candidate

The thesis entitled “**Biochemical and Functional Characterization of Ethnomedicinal Plants of Manipur for Development of Functional Food Product**” is being submitted to School of Engineering, Tezpur University in partial fulfilment for the award of the degree of Doctor of Philosophy in the Department of Food Engineering and Technology is a record of bonafide research work accomplished by me under the supervision of Prof. Laxmikant Shivnath Badwaik.

All helps from various sources have been duly acknowledged.

No part of the thesis has been submitted elsewhere for the award of any other degree.

Date: 24/11/2024

Place: Tezpur


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TEZPUR UNIVERSITY

Certificate of the Supervisor

This is to certify that the thesis entitled “**Biochemical and Functional Characterization of Ethnomedicinal Plants of Manipur for Development of Functional Food Product**” submitted to School of Engineering, Tezpur University in partial fulfilment for the award of the degree of Doctor of Philosophy in the Department of Food Engineering and Technology is a record of research work carried out by Ms.Nemnunhoi Haokip (Roll No. FPP16001) under my supervision and guidance.

All helps received by her from various sources have been duly acknowledged.

No part of the thesis has been submitted elsewhere for award of any other degree.

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List of Abbreviations

μg	Microgram
μm μmol	Micrometer
3D	Three dimensional
a^*	Redness
ABTS	2,2'-azino-bis 3-ethylbenzothiazoline-6-sulphonic acid
A_{control}	Absorbance of control
Al	Aluminum
ANOVA	Analysis of variance
A_{sample}	Absorbance of sample
ATCC	American type culture collection
A_v	Average
b^*	Yellowness
Ca	Calcium
CCD	Central composite design
cm	Centimeter
Co	Cobalt
CO_2	Carbon dioxide
Cu	Copper
CV	Coefficient of variation
df	Degree of freedom
DPPH	2,2-diphenyl-1-picrylhydrazyl
DPP-IV	Dipeptidyl peptidase-IV
EDTA	Ethylenediamine tetraacetic acid
EE	Encapsulation efficiency
FCR	Folin-Ciocalteu reagent
Fe	Iron
FeCl_3	Iron (III) chloride
FeSO_4	Iron sulfate or ferrous sulfate
FRAP	Ferric reducing ability of plasma

FTIR	Fourier transform infrared spectroscopy
g	Gram
GAE	Gallic acid equivalent
GC	Gas chromatography
h	Hour
H	Hydrogen atom
H ₂ SO ₄	Sulfuric acid
HCl	Hydrochloric acid
IC ₅₀	Half maximal inhibitory concentration
IR	Infrared
K	Potassium
kHz	Kilohertz
kJ	Kilo joule
L*	Lightness
LC	Liquid chromatography
LPS	Lipopolysaccharide
M	Molarity
m/z	Mass by charge
MAE	Microwave assisted extraction
mg	Milligram
mm	Millimeter
Mn	Manganese
MSE	Mean square error
MTT	3-(4, 5-dimethylthiazolyl-2)-2, 5-diphenyltetrazolium bromide)
MUFA	Monounsaturated fatty acid
n	Number
N	Normality
Na	Sodium

Na ₂ CO ₃	Sodium carbonate
Na ₂ WO ₄	Sodium tungstate
ND	Not detected
NH ₄ OH	Ammonium hydroxide
Ni	Nickel
nm	Nanometer
O	Oxygen atom
OA	Overall acceptability
OH	Hydroxide
p	p-value
ppm	Parts per million
Q	Quercetin
QE	Quercetin equivalent
R ²	Correlation coefficient
RE	Release efficiency
RMSE	Root mean square error
RP-HPLC	Reversed phase-high performance liquid chromatography
rpm	Rotation per minute
RSM	Response surface methodology
RT	Retention time
s	Second
SCFE	Supercritical fluid extraction
SD	Standard deviation
SEM	Scanning electron microscopy
t	Time
TFC	Total flavonoid content
TPC	Total phenolic content
UAE	Ultrasound assisted extraction
UV	Ultraviolet
W	Watt
w/v	Weight by volume

w/w	Weight by weight
wb	Wet basis
XRD	X-ray diffraction
α	Alpha
θ	Theta